



PERFORMANCE ORIENTED PACKAGING TESTING  
OF  
M548 SHIPPING AND STORAGE CONTAINER  
FOR  
PACKING GROUP II  
SOLID HAZARDOUS MATERIALS

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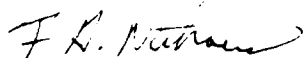
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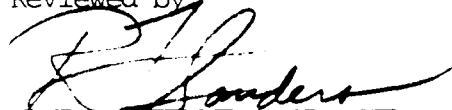
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FIELD	GROUP	SUB-GROUP		
19 ABSTRACT (Continue on reverse if necessary and identify by block number)  Qualification tests were performed to determine whether the reusable M548 Shipping and Storage Container meets the Performance Oriented Packaging (POP) requirements specified by the United Nations Recommendations on the Transportation of Dangerous Goods. The container loaded to a gross weight of 180 pounds successfully met the requirements and retained its contents throughout the tests.				
20 DISTRIBUTION AVAILABILITY OF ABSTRACT <input type="checkbox"/> UNCLASSIFIED UNLIMITED <input checked="" type="checkbox"/> SAME AS RPT <input type="checkbox"/> DTIC USERS			21 ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED	
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## INTRODUCTION

The M548 Shipping and Storage Container with a dummy load of 160 pounds enclosed and an overall weight of 180 pounds was tested to ascertain whether this standard container would meet the requirements of Performance Oriented Packaging (POP) as specified by the United Nations (UN) Recommendation on the Transportation of Dangerous Goods, Document ST/SG/AC.10/1, Revision 6, Chapters 4 and 9. A Base Level Vibration Test was also conducted in accordance with the proposed rulings specified in the Department of Transportation's (DOT) Performance Oriented Packaging Standards HM-181, and Requirements for Explosives HM-181A. The objectives were to evaluate the adequacy of the container in protecting explosive materials which are secured with appropriate dunnage.

## TESTS PERFORMED

### 1. Stacking Test

This test was performed in accordance with ST/SG/AC.10/1, Chapter 9, Paragraph 9.7.6. Three different containers were used, and subjected to a stack weight of 1,440 pounds. The test was performed for 24 hours. After the allowed time, the weight was removed and the containers examined. Any leakage, deterioration, or distortion which could adversely affect transport, reduce strength or cause instability in stacks of packages was considered cause for rejection.

### 2. Drop Test

This test was performed in accordance with ST/SG/AC.10/1 Chapter 9, Paragraph 9.7.3. One container was used for the four flat drops and a second container was used for the corner drop instead of the required five containers (one for each drop). The drops were performed from a height of 4 feet in the following sequence:

- a. Flat Bottom
- b. Flat Top
- c. Flat on Long Side
- d. Flat on Short Side
- e. One Corner

This test was performed at ambient,  $+70 \pm 20$  °F temperature. The contents of the container should be retained within its packaging and exhibit no damage liable to affect safety during transport.

### **3. Base Level Vibration Test**

This test was performed in accordance with Appendix C of Docket No. HM-181, Notice No. 87-4, Federal Register/Vol. 52, No. 215/Friday, November 6, 1987/Proposed Rules. Three sample containers were filled and closed for shipment using nonhazardous materials. One container was loaded with simulated brass weights used during the drop test. One container was loaded with 6 inch long steel bars and the other container was loaded with sand and additional weights (the container would not hold 160 pounds of sand and had to have heavier objects to arrive at the final weight of 180 pounds). The sand filled container was deemed to be the worst case scenario. The three containers were placed on a vibrating platform that had a vertical amplitude (peak-to-peak displacement) of one inch. The containers were not restrained during vibration except by a fence attached to the test surface to prevent them from falling off the table. The containers were tested for 60 minutes in their normal shipping position. The vibratory input to the container was at a frequency that caused the container to be raised from the vibrating platform to such a degree that a piece of material of approximately 1/16" (1.6mm) thickness could be passed between the bottom of the container and the platform.

#### **PASS/FAIL (UN CRITERIA)**

The criteria for passing the stacking test is outlined in Paragraph 9.7.6.3 of ST/SG/AC.10/1 and states the following: "No test sample should show any deterioration which could adversely affect transport safety or any distortion liable to reduce its strength or cause instability in stacks of packages".

The criteria for passing the drop test is outlined in Paragraph 9.7.3.5 of ST/SG/AC.10/1 and states the following: "Where a packaging for solids undergoes a drop test and its upper face strikes the target, the test sample passes the test if the entire contents are retained by an inner packaging or inner receptacle (e.g., a plastic bag), even if the closure is no longer sift-proof".

#### **PASS/FAIL (HM-181 CRITERIA)**

The criteria for passing the Base Level Vibration Test is outlined in Paragraphs 4 & 5 of Appendix C, Docket No. HM-181, Notice No. 87-4, Federal Register/Vol 52, No 215/Friday, November 6, 1987/Proposed Rules, and states the following: "Immediately following the period of vibration, each package shall be removed from the platform, turned on its side and observed for any evidence of leakage. Rupture or leakage from any of the packages constitutes failure of the test".

## TEST RESULTS

1. **Stacking Test**  
Satisfactory.
2. **Drop Test**  
Satisfactory, see Figure 1.
3. **Base Level Vibration Test**  
Satisfactory with no leakage.

## DISCUSSION

### 1. Stacking Test

The stacking test was performed with a load of 1440 pounds for 24 hours. Each container was visibly checked after the 24 hour period was over. There was no leakage, distortion, or deterioration to any of the containers as a result of this test.

### 2. Drop Test

After each drop, the containers were inspected for any damage which would be a cause for rejection. Final inspection indicated damage was minimal with some denting noted, particularly after the final corner drop. Both containers were intact and serviceable on completion of the tests. The standard wire seal (Drawing 19200-8794342) used to secure each end of the container also remained intact during the entire test. There was no loss or spillage of the contents and the container successfully passed the test.

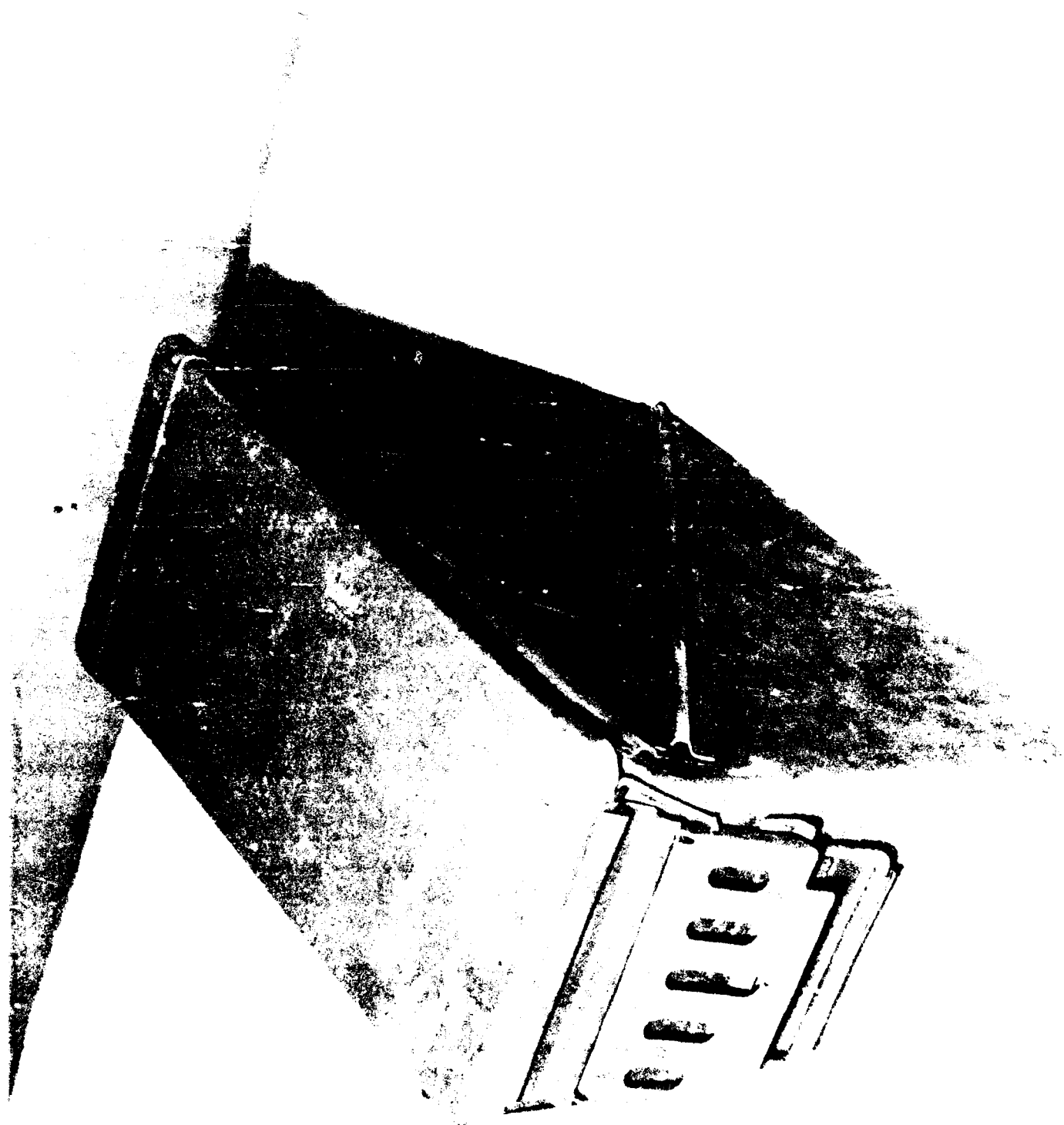
### 3. Base Level Vibration Test

Immediately after the vibration test was completed, each container was removed from the platform, turned on its side and observed for any evidence of leakage. The latches remained intact and there was no evidence of leakage of the solid weights, steel bars, or the sand.

### 4. Additional tests

A complete series of tests was performed earlier on the M548 container using a gross weight of 125.4 pounds. The container passed all the tests including five (5) drops of the same container from a height of four (4) feet, Figure 2. All the tests were repeated, however, after discussion with NWS Earle revealed that several containers currently in the system had a gross weight of 178 pounds.

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## REFERENCE MATERIAL

United Nations "Recommendation on the Transportation of Dangerous Goods", ST/SG/AC.10/1, Revision 6

Docket No. HM-181, Notice No. 87-4, Federal Register/Vol. 52, No. 215/Friday, November 6, 1987/Performance-Oriented Packaging Standards; Proposed Rulemaking

Docket No HM-181A; Notice No. 90-5, Federal Register/Vol. 55, No. 85/Wednesday, May 2, 1990/Requirements for Explosives; Proposed Rulemaking

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## TEST DATA SHEET

<b>DATA SHEET:</b>	
Container: M548 SHIPPING AND STORAGE CONTAINER	
Type: 4A1	UN Code: See Table
Specification Number: DWG 19200-7258943	Material: Steel
Capacity: 81 kg (180 pounds)	Dimensions: .47 m (L) x .21 m (W) x .37 m (H) (18.59" L x 8.29" W x 14.59" H)
Closure (Method/type): Removable lid	Tare Weight: 8.40 kg (19.10 pounds)
Additional Description: This is a reuseable steel shipping and storage container [NSN 8140-00-739-0233] with a removable cover.	
<b>PRODUCT(S)</b> See Table	
Name: See Table	
United Nations Number: See Table	
United Nations Packing Group: II	
Physical State (Solid, Liquid or Gas): Solid	
Vapor Pressure (Liquids Only): N/A At 50°C: N/A At 55°C: N/A	
Consistency/Viscosity: N/A	Density/Specific Gravity: N/A
Amount Per Container: See Table	
Net Weight: See Table	
<b>TEST PRODUCT(S):</b>	
Name: Simulated Weights or Sand	Physical State: Solid
Size : 9.88" x 7.75" x 1.25" or .88" Diameter x 6.0" or granulated sand & misc. wts.	Quantity : Six (6) Brass Weights or 155 Steel Rods, or 160 lbs.
Density/Specific Gravity: N/A	
Dunnage: PPP-C-1752 Foam Polyethylene	
Amount Per Container: N/A	Gross Weight: 81 kg (180 lbs.)

TABLE 1

DODIC OR NALC	NSN	HM ITEM	TYPE	PACKING DWG	HAZARD CLASS	UN No.	#/ CNTR	WGT KG
A165	1305-00-926-3942	7.62	LNKD		1.4	0012	1500	58.5
A658	1305-00-723-5482	20MM	LNKD		1.2	0321	100	34.7
A659	1305-00-935-6171	20MM	M242		1.4	0321	200	65.8
A661	1305-00-497-0121	20MM	M55		1.4	0339	100	39.6
A661	1305-01-153-1799	20MM	M55		1.4	0339	100	39.6
A662	1305-00-497-0120	20MM	M55		1.2	0321	100	39.6
A664	1305-00-182-3158	20MM	LNKD		1.4	0339	100	39.6
A665	1305-00-182-3250	20MM	LNKD		1.2	0321	100	39.6
A676	1305-01-185-3265	20MM	MK149		1.4	0339	100	39.6
A677	1305-01-213-9658	20MM	PGU28		1.2	0321	250	75.4
A678	1305-01-213-9656	20MM	PGU27		1.4	0339	250	75.4
A679	1305-01-213-9657	20MM	PGU30		1.4	0339	250	75.4
A692	1305-01-288-4978	20MM			1.4	0339		
A764	1305-01-230-3932	20MM			1.2	0321		
A777	1305-00-965-0748	20MM	M204		1.4	0339	200	65.8
A785	1305-00-221-6466	20MM	M210		1.2	0321	200	61.7
A834	1305-00-180-9271	20MM	LNKD		1.2	0321	150	61.3
A890	1305-00-935-9104	20MM	M56A3		1.2	0321	200	51.3
A891	1305-00-752-8114	20MM	M55A2		1.4	0339	200	61.7
A891	1305-01-115-4560	20MM	M55A2		1.4	0339	250	77.2
A896	1305-00-169-1784	20MM	LNKD		1.4	0339	100	37.7
A919	1305-00-965-0560	20MM	M56A3		1.2	0321	100	39.6
A926	1305-00-180-9268	20MM	M55A2		1.4	0339	100	34.5
A926	1305-00-965-0559	20MM	M55A2		1.4	0339	100	34.7
B542	1310-01-159-8043	40MM	M430	9362543	1.1(04)	0006	48	27.0
B570	1310-00-471-3615	40MM	M406		1.2	0321	72	26.6
B571	1310-01-196-2654	40MM	M383	9362543	1.1(04)	0006	48	27.0
B576	1310-01-159-3184	40MM	M385	9362543	1.2(04)	0328	48	27.0
B577	1310-00-965-0738	40MM	M407A1		1.2(04)	0328	72	26.3
B584	1310-01-218-7069	40MM	M918	9362543	1.2(08)	0339	48	27.0
F732	1325-00-103-2656	FZ	MK339		1.4	0410	9	29.5
F740	1325-00-059-3729	FZ	MK339		1.4	0410	9	29.5
F762	1325-01-150-2316	FZ	FMU139		1.2	0409	9	30.0
F810	1325-01-255-6337	FZ	FMU139		1.2	0409		
H890	1340-01-230-9037	2.75	MK67	1601AS500	1.2(04)	0006	8	48.0
H892	1340-01-230-9038	2.75	MK67	1601AS500	1.2(04)	0006	8	48.0
H893	1340-01-230-9039	2.75	MK67	1601AS500	1.2(04)	0006	8	48.0
LW16	1370-01-305-6342	FLARE	MJU22	1650AS200	1.3	0093	40	27.3
L272	1370-00-164-5286	SIC	MK99		1.4	0191	20	22.7
L273	1370-01-095-2962	SIC	MK99		1.4	0191	20	22.7
L273	1370-91-177-4072	SIC	MK99		1.4	0191	20	22.7
L540	1370-01-326-2537	SIM	SM875	3176AS200	1.4	0403	120	18.9
H708	1340-00-360-5050	35MM	M73	9287703	1.2(04)	0182	30	15.9

TABLE I

DODIC OR NALC	NSN	HM ITEM	TYPE	PACKING DWG	HAZARD CLASS	UN No.	#/ CNTR	WGT KG
MU40		CORD	DET	6665116			6	
MU41		CORD	DET	6665115			7	
MU42		CORD	DET	6665114			12	
N288	1390-01-050-8897	FUZE	M734	9381685	1.2(04)		72	29.8
N342	1390-01-124-7584	FUZE	M935	9381686	1.2(04)	0107	72	32.1
N658	1390-01-240-9257	FUZE	M936	9381686	1.1	0408	72	32.1